

[0268] 45. The reader instrument of item 39, 40, 41, 42, 43 or 44, wherein the waveguide includes a refractive volume integrally formed from the waveguide for directing the illumination to the assay region.

[0269] 46. The reader instrument of item 39, 40, 41, 42, 43, 44 or 45, wherein the image sensor is disposed perpendicular to the planar waveguide.

[0270] 47. The reader instrument of item 39, 40, 41, 42, 43, 44, 45 or 46, wherein the image sensor is configured for reading supplemental information disposed on the cartridge.

[0271] 48. A system for performing a biochemical assay on a sample, the system including: A) a cartridge including a planar waveguide having a plurality of capture molecules bound to a planar surface thereof, a refractive volume for optically coupling a light beam provided by a light source to the planar waveguide, the refractive volume being integrally formed from the planar waveguide, and a sample chamber for receiving and containing the sample such that the sample comes into contact with the plurality of capture molecules; and B) a reader instrument including a receiving mechanism for positioning the cartridge therein, the light source for providing the light beam, a detector for detecting a light signal from a portion of the planar surface on which the plurality of capture molecules is bound, and an analysis module for receiving and analyzing the light signal from the detector; wherein the light beam is incident on the refractive volume in a plane parallel to and offset from the planar waveguide, and wherein the refractive volume is configured for refracting the light beam such that the light beam is focused at the planar surface at a non-zero, internal propagation angle relative to the planar surface for all light within the light beam.

[0272] 49. The system of item 48, wherein the plurality of capture molecules include at least one molecule selected from the group consisting of a peptide, a polypeptide, a protein, an antibody, an antigen, a polysaccharide, sugar, an oligonucleotide, a polynucleotide, a synthetic molecule, an inorganic molecule, an organic molecule, and combinations thereof.

[0273] 50. The system of item 48 or 49, wherein the planar waveguide is formed of an optically transparent material selected from the group consisting of cyclic olefin polymer, cyclic olefin copolymer, polyolefin, polystyrene, acrylic, polymethylmethacrylate, and polycarbonate.

[0274] 51. The system of item 48, 49 or 50, wherein the planar surface is modified using a process selected from the group consisting of plasma activation, chemical vapor deposition, liquid phase deposition, and surface polymerization of an activation chemistry, and combinations thereof.

[0275] 52. The system of item 48, 49, 50 or 51, the sample containing antibodies and viral antigen, wherein the cartridge and the reader instrument are configured to cooperate so as to detect both antibodies and viral antigen in the sample.

[0276] 53. The system of item 48, 49, 50, 51 or 52, wherein the plurality of capture molecules are arranged as an array including at least two reaction sites, each of the at least two reaction sites being formed by printing a composition onto the planar surface, the composition including at least one of the capture molecules.

[0277] 54. The system of item 53, wherein the at least two reaction sites containing different compositions.

[0278] 55. The system of item 53 or 54, wherein the at least two reaction sites include capture molecules selected from the group consisting of HIV antigens p17, p24, p31, gp41,

p51, p55, p66, gp120, gp160, p41 Type O, p36 of HIV-2, antibodies against HIV antigen p24, and combinations thereof.

[0279] 56. The system of item 48, 49, 50, 51, 52 or 53, the reader instrument further including a beam homogenizer.

[0280] 57. A method for performing a biochemical assay on a sample, the method including: A) providing a cartridge, which cartridge includes a planar waveguide having a plurality of capture molecules bound to a planar surface thereof, a refractive volume for optically coupling a light beam provided by a light source to the planar waveguide, the refractive volume being integrally formed from the planar waveguide, and a sample chamber for receiving and containing the sample such that the sample comes into contact with the plurality of capture molecules; B) introducing the sample into the sample chamber of the cartridge; C) providing a reader instrument, which reader instrument includes a receiving mechanism for positioning the cartridge therein, the light source for providing the light beam, a detector for detecting a light signal from a portion of the planar surface on which the plurality of capture molecules is bound, and an analysis module for receiving and analyzing the light signal from the detector; D) inserting the cartridge, containing the sample, into the reader instrument; E) using the light source, illuminating a portion of the planar waveguide at which the plurality of capture molecules are bound such that, if the sample includes a target analyte, the target analyte interacts with the plurality of capture molecules so as to produce a light signal; F) capturing the light signal; and G) analyzing the light signal; wherein illuminating includes directing the light beam at the refractive volume such that the light beam is incident on the refractive volume in a plane parallel to and offset from the planar waveguide, and refracting the light beam such that the light beam is focused at the planar surface at a non-zero, internal propagation angle relative to the planar surface for all light within the light beam.

[0281] 58. The method of item 57, wherein the plurality of capture molecules include at least one molecule selected from the group consisting of a peptide, a polypeptide, a protein, an antibody, an antigen, a polysaccharide, sugar, an oligonucleotide, a polynucleotide, a synthetic molecule, an inorganic molecule, an organic molecule, and combinations thereof.

[0282] 59. The method of item 57 or 58, further including modifying the planar surface using a process selected from the group consisting of plasma activation, chemical vapor deposition, liquid phase deposition, and surface polymerization of an activation chemistry, and combinations thereof.

[0283] 60. The method of item 57, 58 or 59, the sample containing antibodies and viral antigen, the method further including detecting both antibodies and viral antigen in the sample.

[0284] 61. The method of item 60, wherein the plurality of capture molecules are selected from the group consisting of HIV antigens p17, p24, p31, gp41, p51, p55, p66, gp120, gp160, p41 Type O, p36 of HIV-2, antibodies against HIV antigen p24, and combinations thereof.

[0285] 62. The method of item 57, 58, 59 or 60, wherein providing the reader instrument further including homogenizing the light beam before the light beam is optically coupled to the planar waveguide.

[0286] 63. A kit for performing a biochemical assay on a sample, the kit including: A) a cartridge including a planar waveguide having a plurality of capture molecules bound to a planar surface thereof, a refractive volume for optically cou-